Metallurgical Coal Mining in Alberta: Policy, Regulation, Research and Questions

Presentation to Coal Policy Committee

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August 24, 2021

Online

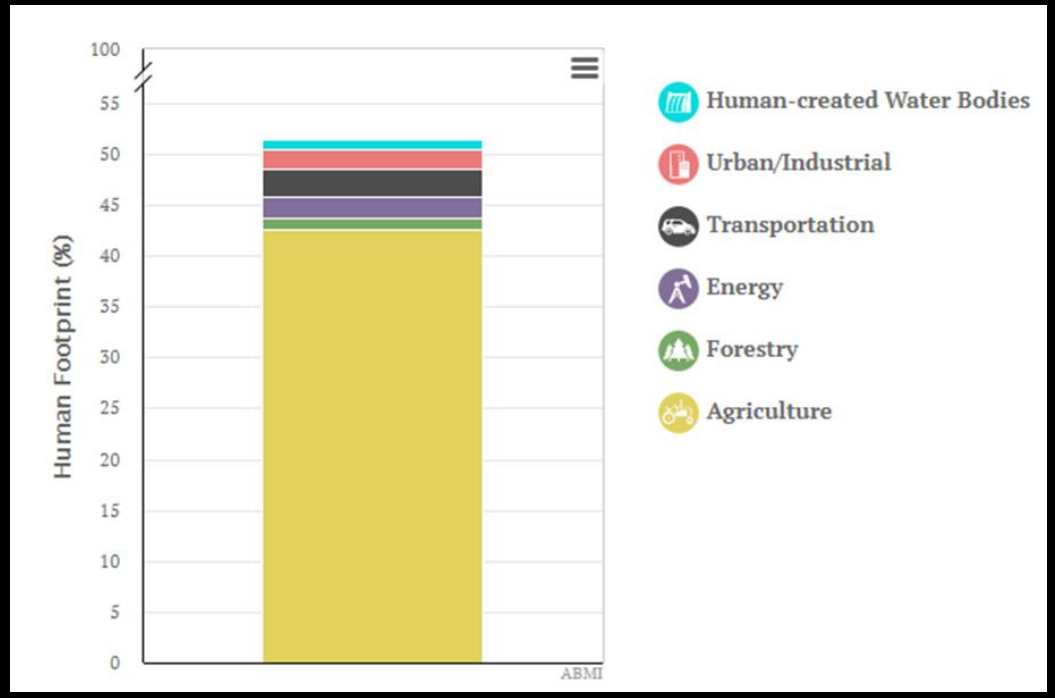
Mandy Olsgard M.Sc., P. Bio

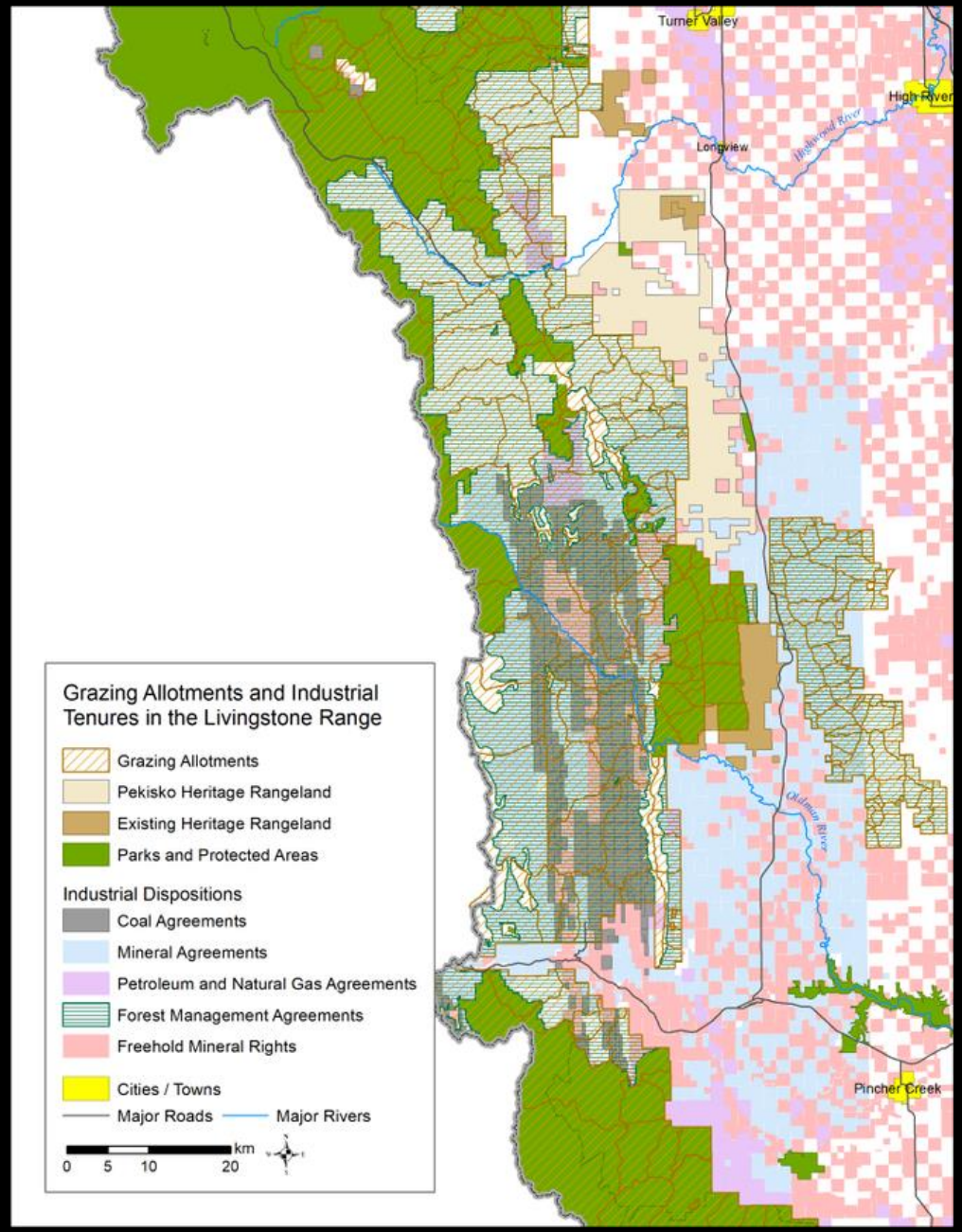
INTEGRATED TOXICOLOGY SOLUTIONS

Overview

- Alberta Policy and Regulatory Gaps (summary July 13 presentation)
- Community Health in Surface Coal Mine Areas
- Pekisko Air Quality and Health Risk Study
- Questions

Changing Land Use? Agriculture to Energy

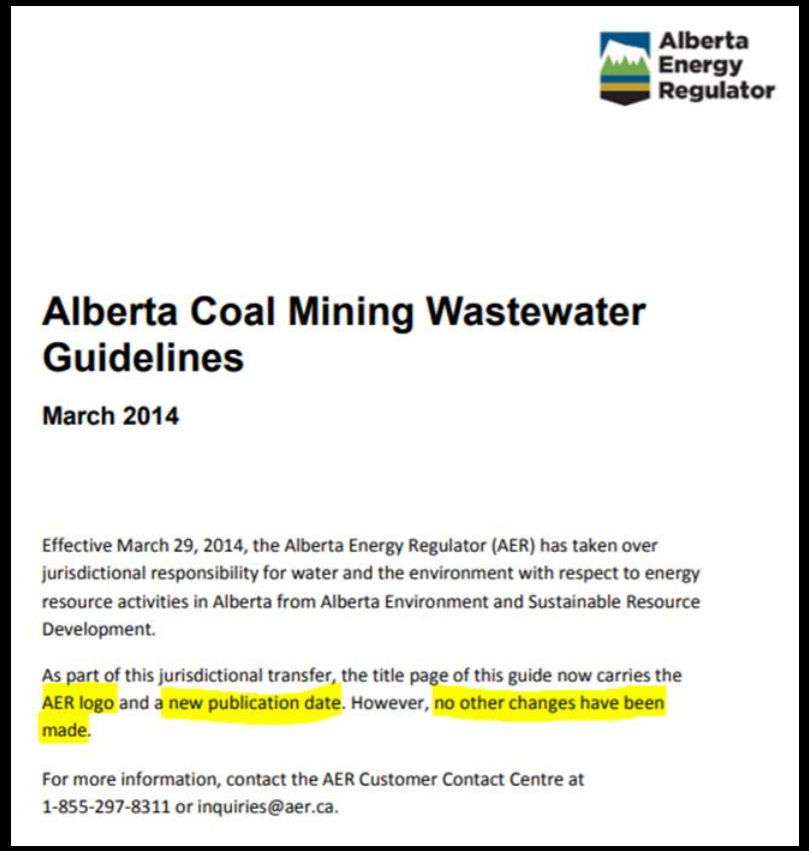




Adopted from ABMI (2016) published at: https://abmi.ca/home/reports/2018/human-footprint/details.html?id=7.

Summary of Alberta Policy and Regulatory Gaps

1. Outdated Policy and “lazy” regulatory process



Alberta Energy Regulator

Alberta Coal Mining Wastewater Guidelines

March 2014

Effective March 29, 2014, the Alberta Energy Regulator (AER) has taken over jurisdictional responsibility for water and the environment with respect to energy resource activities in Alberta from Alberta Environment and Sustainable Resource Development.

As part of this jurisdictional transfer, the title page of this guide now carries the AER logo and a new publication date. However, no other changes have been made.

For more information, contact the AER Customer Contact Centre at 1-855-297-8311 or inquiries@aer.ca.

2. Highest risk coal mine contaminants not measured in coal mine releases

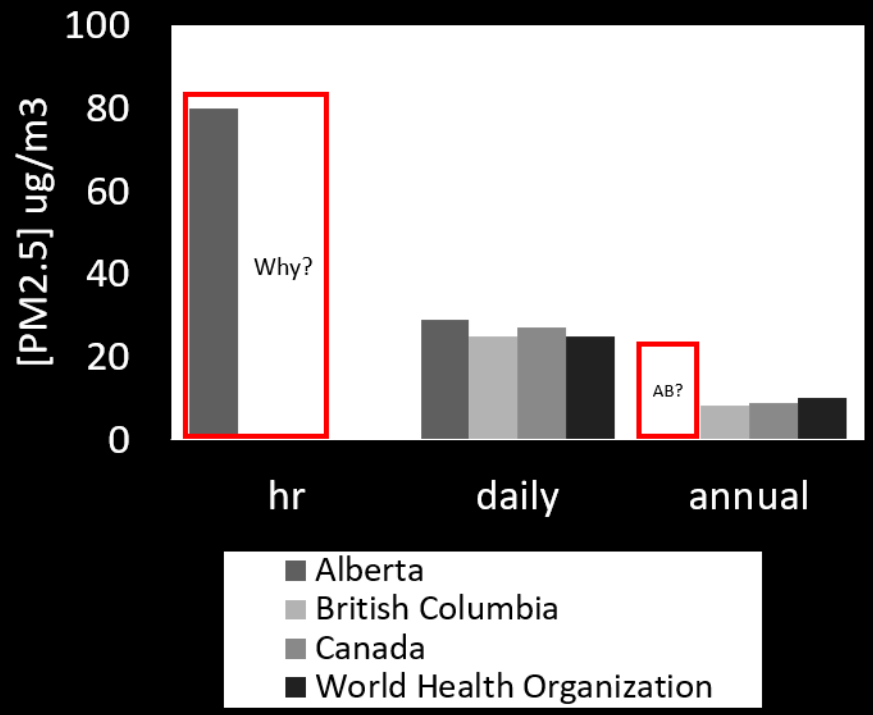
- Selenium (and other metals)
- Nutrients
- Sulphate
- Carbonate (Ca)

TABLE 1. WASTEWATER RELEASE LIMITS

Parameter	LIMITATIONS	
	Maximum Daily	Maximum Daily Average (for any month)
Total Suspended Solids (TSS)	<350 mg/L	<50 mg/L
pH	Between 6.0 to 9.5 at all times	
Floating Solids and Foam	None - except in trace amounts	
Oil and Grease	No visible sheen	

Summary of Alberta Policy and Regulatory Gaps

3. Alberta has higher health based guidelines than global standard



4. SSRP is incomplete, lacks monitoring in Pekisko area, reporting is delayed

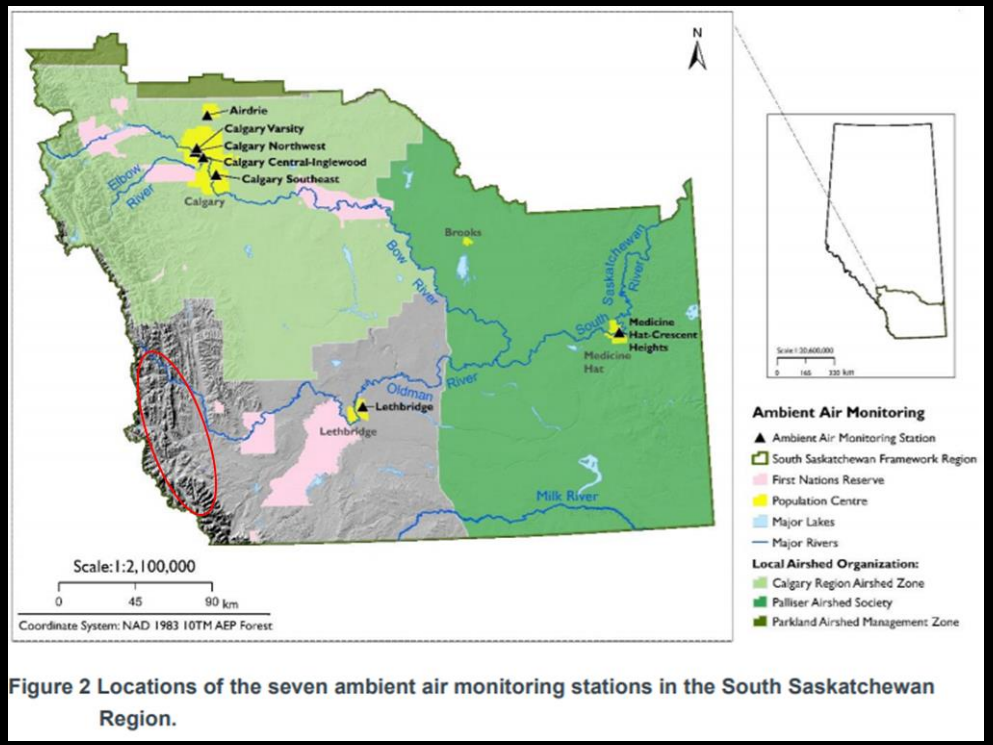


Figure 2 Locations of the seven ambient air monitoring stations in the South Saskatchewan Region.

Thi, A. 2020. 2018 Status of Air Quality, South Saskatchewan Region, Alberta. Government of Alberta, Ministry of Environment and Parks. ISBN 978-1-4601-4894-5. Available at: https://open.alberta.ca/publications/status-of-air-quality-south-saskatchewan-region-alberta.

Summary of Alberta Policy and Regulatory Gaps

5. AER has not enforced management action for repeated non-compliances at operating coal mine

Groundwater

Table 4-2 Cheviot Mine Area 2019 Summary of CCME Exceedances

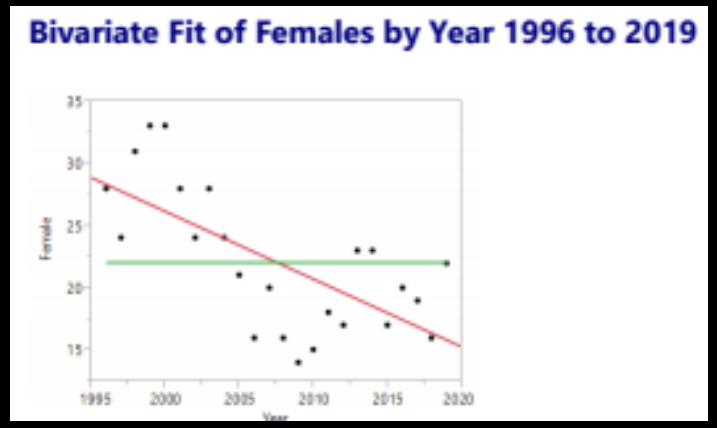
Parameter	CCME Guideline	Well ID	N_x	N_{total}	$N_{Cheviot}$	Min	Max	Avg
						mg/L		
Nitrate (as N)	13 mg/L	CV_15-02	1	1	137	31	31	31
Selenium (Se)	1.0 ug/L	CV_15-01	1	1	100	0.00148	0.00148	0.00148
		CV_TH18	23	31		0.0019	0.00755	0.00505
		CV_THWW-0804	43	60		0.0019	0.00876	0.00412
Copper (Cu)	0.0005 mg/L	CV_15-01	1	1	79	0.00574	0.00574	0.00574
		CV_THWW-0804	1	48		0.00393	0.00393	0.00393
Iron (Fe)	0.01 mg/L	CV_15-01	1	1	79	2.53	2.53	2.53
		CV_THWW-0804	1	48		1.32	1.73	1.53
Lead (Pb)	0.00005 mg/L	CV_15-01	1	1	50	0.00166	0.00166	0.00166

N_x indicates number of exceedances from the well, N_{total} indicates total sample size from the well, and $N_{Cheviot}$ indicates total number of samples analyzed from all the Cheviot wells. *Total metals were included in the analysis for discharging wells.

6 RESPONSES TO ALBERTA GOVERNMENT ON 2017 GROUNDWATER MONITORING REPORT

There were no comments from Alberta Environment and Parks (AEP) and/or Alberta Energy Regulator (AER) on the 2017 groundwater monitoring summary report.

Harlequin ducks



2.3 Population Trend

A regression of the number of female Harlequin Ducks in the McLeod watershed against year between 1996 and 2019 produced an estimate of -0.54 (se 0.13) females/year (P = 0.0003, CI = -0.81 to -0.28) a significant decline over the 24-year period (Figure 3, Appendix II). Male harlequins declined during the same time by -0.84 (se 0.16) males/year (P = <.0001, CI = -1.17 to -0.51).

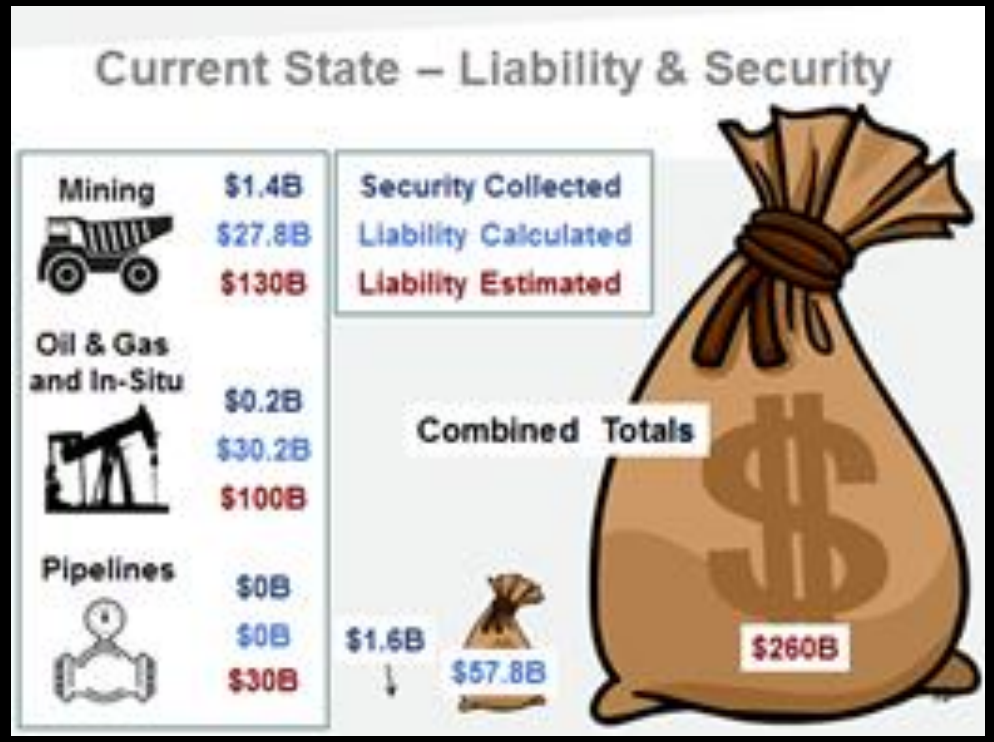
Air

Table 2 Summary Statistics for all 5 Sites Compared to Residential/Recreational Guideline

Summary Statistics	Total Dustfall (mg/ 100 cm^2/ 30 days)
Count	60
Average	72
Minimum	11
Maximum	550
# of Exceedances	24
Compliance %	60

Summary of Alberta Policy and Regulatory Gaps

6. Alberta regulator has allowed over $260 billion in liability to accrue from energy development



7. Government regulated liability management system is affected by market prices and industry lobbying

Impact of 2020

Extremely low oil prices in 2020 reinforced problems with the MFSP formula. The program was never designed for a drastic swing in oil prices that the oil sector experienced in 2020. A year ago, the price of West Texas Intermediate reached a historical minimum of –US$37 per barrel and it is currently more than US$60 per barrel.

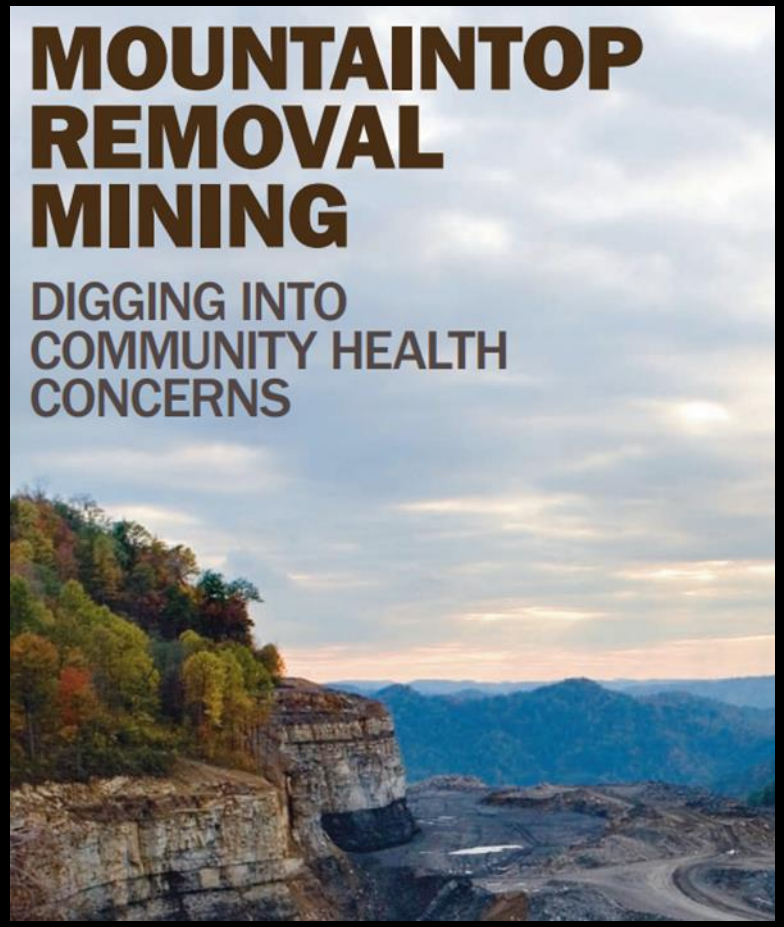
While the price of oil has already begun to recover, the extremely low oil prices in 2020 skewed the calculation of what oil sands companies would have been required to pay for reclamation security in 2021.

As a result, the Government of Alberta is making a change in the interim to the calculation while the review is underway, to ensure security amounts align with the intent of the program.

Questions

Open pit coal mining impacts community health

- United States
  - Appalachian (West Virginia)
- Australia
  - Bowen Basin and Hunter Valley
- China
  - Haerwusu (Inner Mongolia), Xinjiang, Shanxi
- India
  - Talcher and Jharia



Not Just a Coalmine: Shifting Grounds of Community Opposition to Coal Mining in Southeastern Australia

Linda Connor , Sonia Freeman & Nick Higginbotham

Systematic Review of Community Health Impacts of Mountaintop Removal Mining

Abee L. Boyles[1,*], Robyn B. Blain[2], Johanna R. Rochester[2], Raghavendhran Avanasi[2], Susan B. Goldhaber[2], Sofie McComb[2], Stephanie D. Holmgren[3], Scott A. Masten[4], and Kristina A. Thayer[1]

Australia's new coal mine plan: a "public health disaster"

Chris McCall

Air Pollution Emissions 2008–2018 from Australian Coal Mining: Implications for Public and Occupational Health

Michael Hendryx [1,*], Mohammad Saidul Islam [2], Guang-Hui Dong [3] and Gunther Paul [4]

Coal and health in the Hunter:
Lessons from one valley for the world

Particulate matter pollution in opencast coal mining areas: a threat to human health and environment

Sneha Gautam, Aditya Kumar Patra, Satya Prakash Sahu & Michael Hitch

Impacts of opencast coal mine and mine fire on the trace elements' content of the surrounding soil *vis-à-vis* human health risk

Reginald E. Masto, Lal C. Ram, Joshy George, Vetrivel A. Selvi, Awadhesh K. Sinha, Santosh K. Verma, ...show all

Managing the cumulative impacts of coal mining on regional communities and environments in Australia

Daniel M. Franks , David Brereton & Chris J. Moran

Evaluation of metal contamination and risk assessment to human health in a coal mine region of India: A case study of the North Karanpura coalfield

Babita Neogi, Ashwani Kumar Tiwari, Abhay Kumar Singh & D. D. Pathak

Pages 2011-2023 | Received 10 Nov 2017, Accepted 31 Jan 2018, Published online: 26 Feb 2018

Ecological risk assessment of soil contamination by trace elements around coal mining area

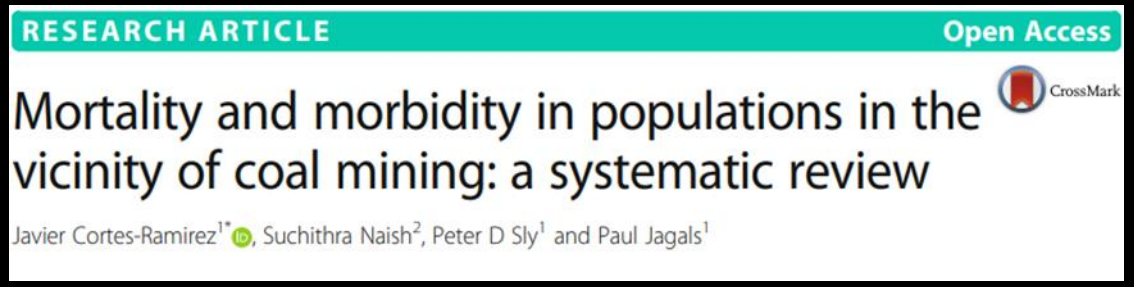
Bhanu Pandey [1] · Madhoolika Agrawal [1] · Siddharth Singh [2]

Potential harmful elements in coal dust and human health risk assessment near the mining areas in Cherat, Pakistan

Muhammad Ishtiaq, Noor Jehan, Said Akbar Khan, Said Muhammad, Umar Saddique, Bushra Iftikhar & Zahidullah

Risk factors increase with proximity to surface coal mines (Cortes-Ramirez, J.M., et. al., 2018)

- Mortality
  - Chronic diseases of the circulatory system (Talbot et al., 2015; Esch and Hendryx, 2011)
  - Cancer of the lung, colon, breast, prostate, and all combined cancers (Mueller et. al., 2015; Hendryx et. al., 2010)
- Morbidity
  - Congenital anomalies (Ahern et. al., 2011)


RESEARCH ARTICLE Open Access

Mortality and morbidity in populations in the vicinity of coal mining: a systematic review

Javier Cortes-Ramirez[1*], Suchithra Naish[2], Peter D Sly[1] and Paul Jagals[1]

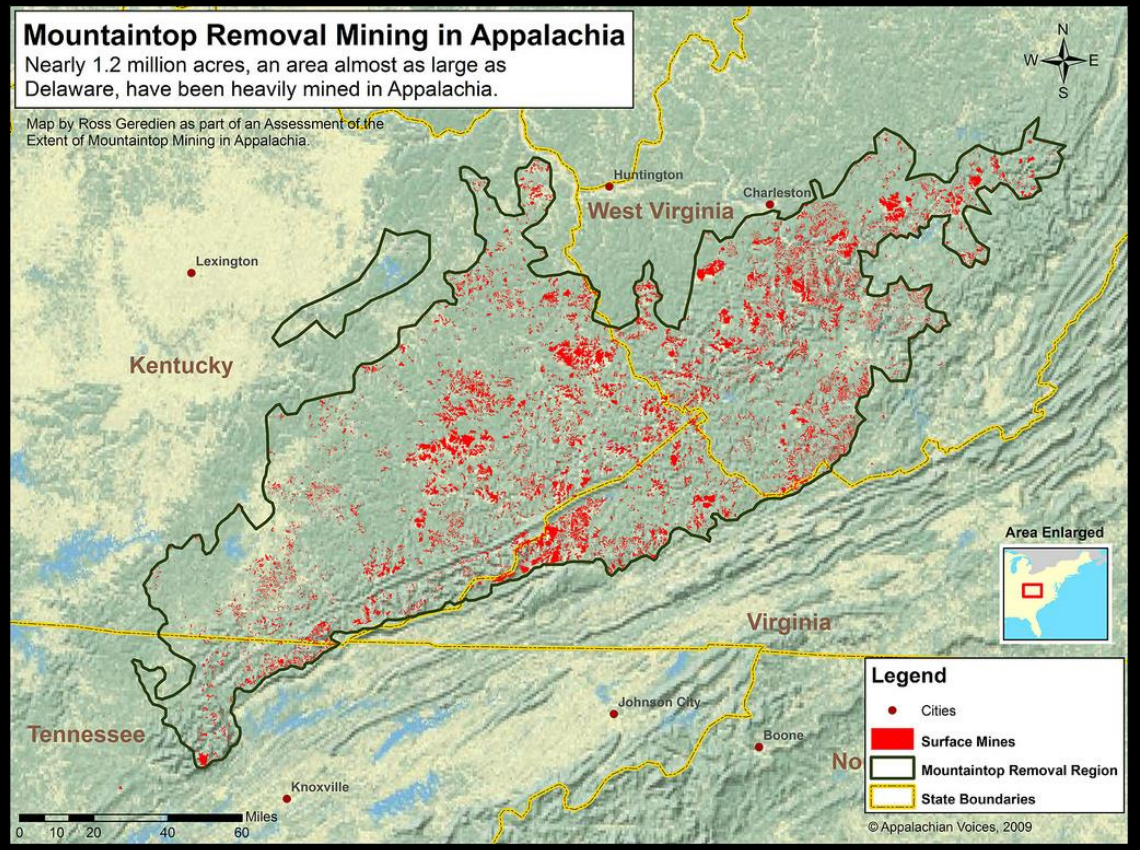
Carl E. Zipper
Jeff Skousen *Editors*

Appalachia's Coal-Mined Landscapes

Resources and Communities in a New Energy Era

Human Health in Coalfield Communities of Appalachia

Julia M. Gohlke



https://appvoices.org/images/campaigns/mtr/?C=M;O=A

Decreased life expectancy in Appalachia coal counties in West Virginia

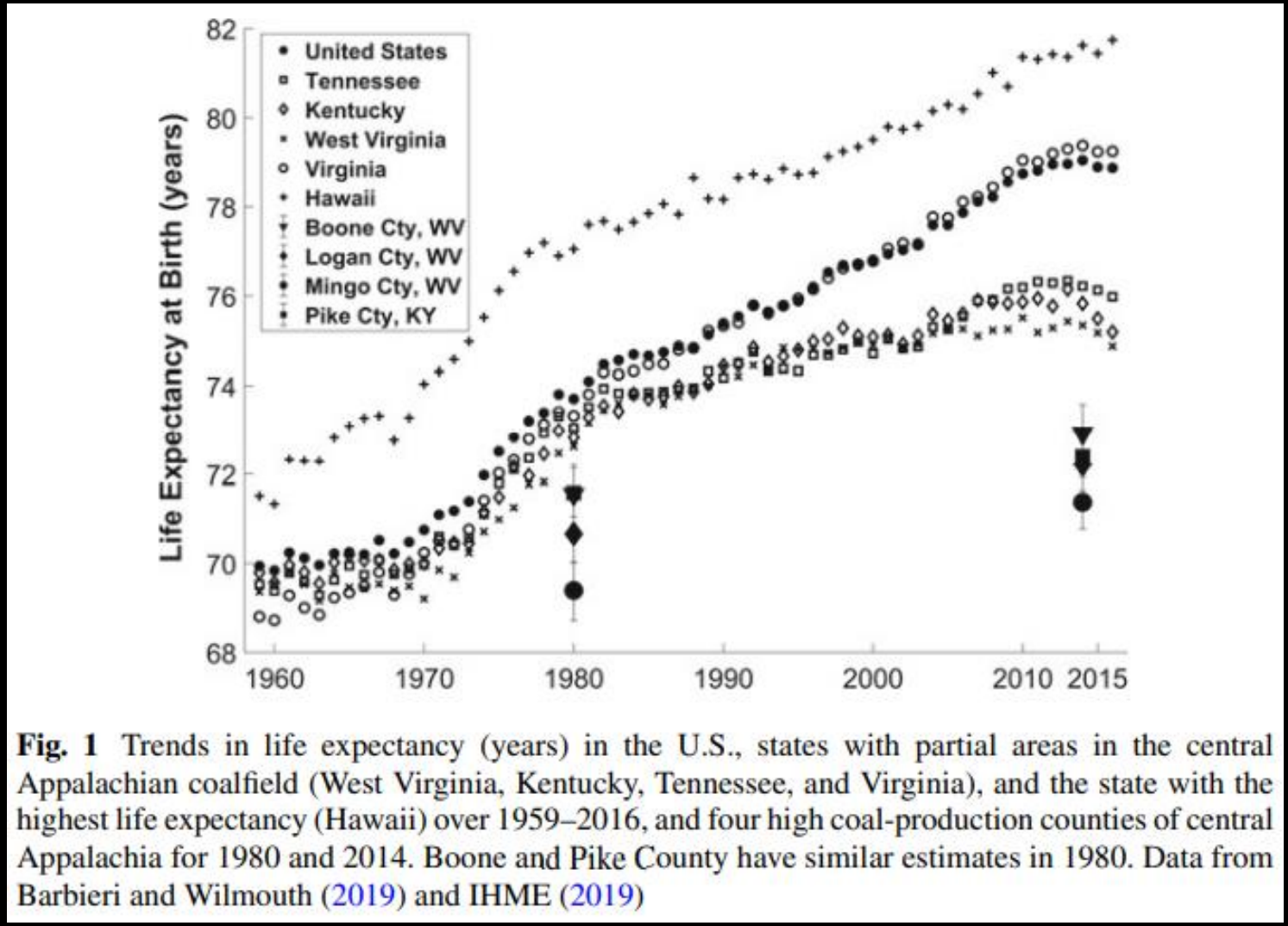


Fig. 1 Trends in life expectancy (years) in the U.S., states with partial areas in the central Appalachian coalfield (West Virginia, Kentucky, Tennessee, and Virginia), and the state with the highest life expectancy (Hawaii) over 1959–2016, and four high coal-production counties of central Appalachia for 1980 and 2014. Boone and Pike County have similar estimates in 1980. Data from Barbieri and Wilmouth (2019) and IHME (2019)

Gohlke, J.M., 2021. Human health in coalfield communities of Appalachia. In *Appalachia's Coal-Mined Landscapes* (pp. 311-336). Springer, Cham.

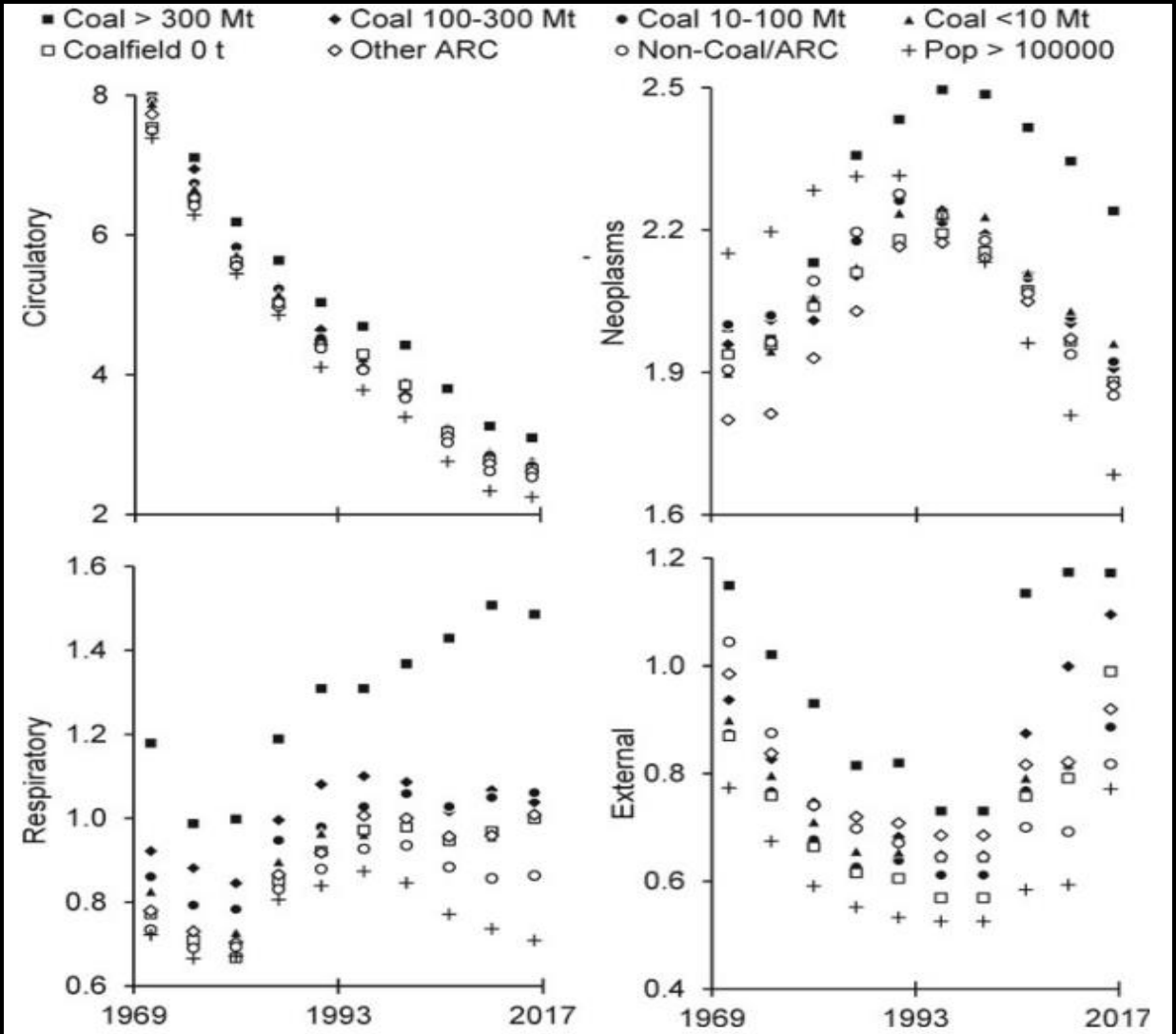
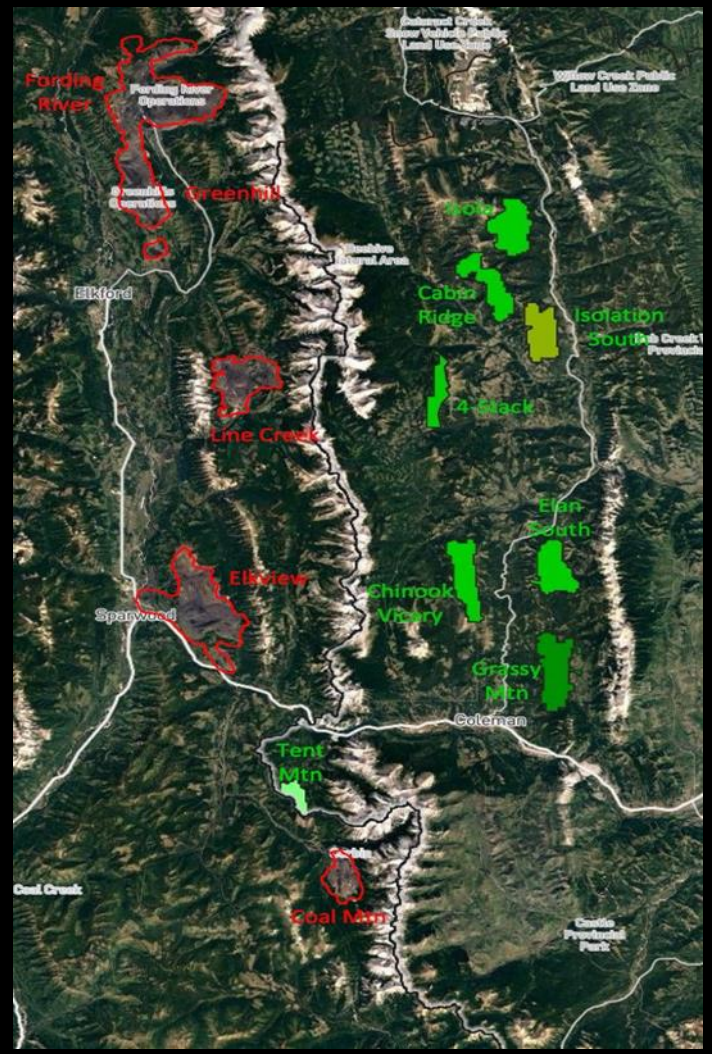


Fig. 7 Cause-specific mortality rates (per 1000 population) by county type. Population-weighted means were calculated for each county type using county-level cause-specific age-adjusted mortality rates from CDC (2020) for five-year periods. Primary causes are Circulatory (CDC codes I00-I99), Neoplasms (C00-D48), Respiratory (J00-J98), and External (V01-Y89)

Gohlke, J.M., 2021. Human health in coalfield communities of Appalachia. In *Appalachia's Coal-Mined Landscapes* (pp. 311-336). Springer, Cham.



Livingstone Area annual coal production per year
14 – 24 Mt

Stelfox, J.B, and W.F. Donahue. 2021. Assessing watershed scale consequences of coal surface mines in the headwaters of the Oldman River Watershed (ORW)

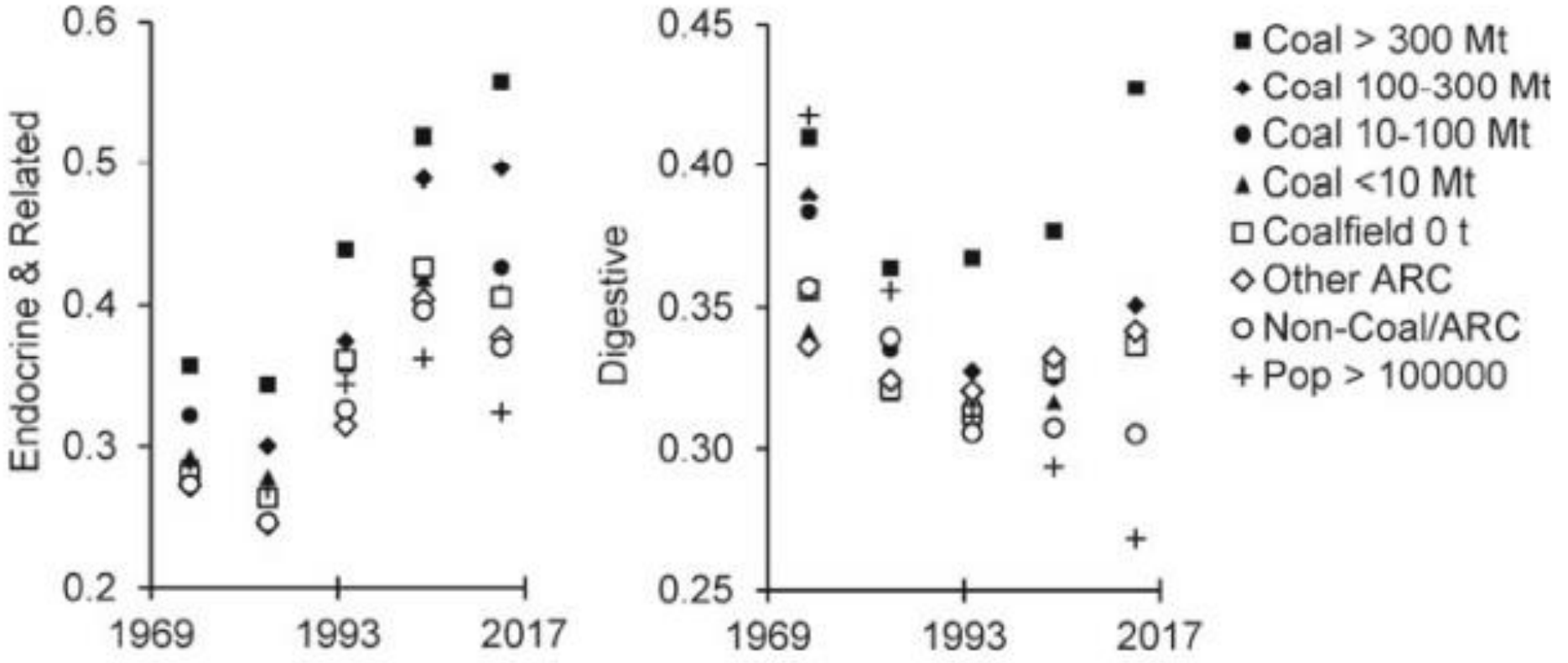


Fig. 8 Cause-specific mortality rates (per 1000 population) by county type. Population-weighted means were calculated for each county type using county-level cause-specific age-adjusted mortality rates from CDC (2020) for ten-year periods. Primary causes are Endocrine, Nutritional and Metabolic (CDC codes E00-E88) and Digestive (K00-K92)

Gohlke, J.M., 2021. Human health in coalfield communities of Appalachia.
In *Appalachia's Coal-Mined Landscapes* (pp. 311-336). Springer, Cham.

Low birth weight and preterm births more frequent in populations close to surface coal mines

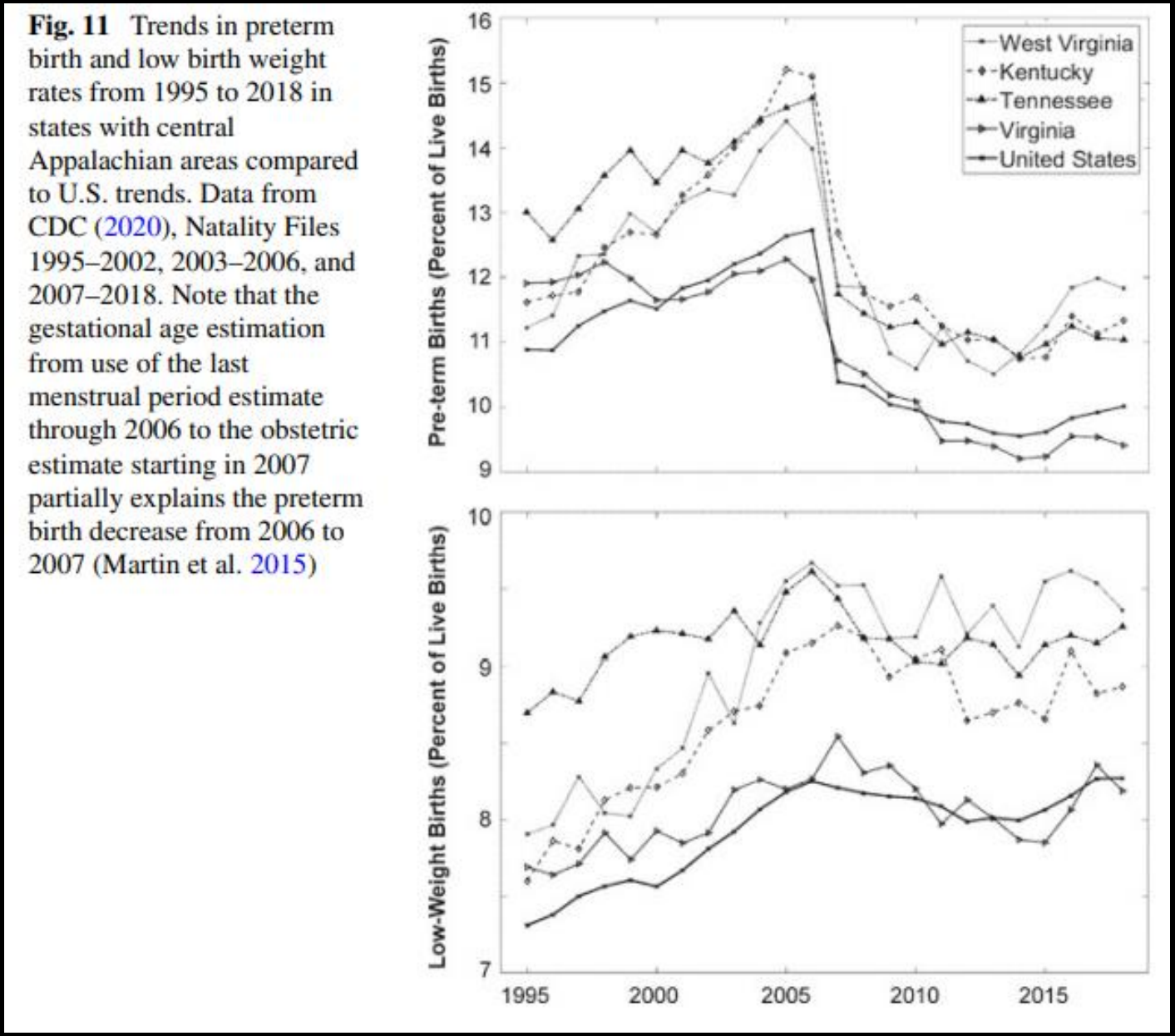


Fig. 11 Trends in preterm birth and low birth weight rates from 1995 to 2018 in states with central Appalachian areas compared to U.S. trends. Data from CDC (2020), Natality Files 1995–2002, 2003–2006, and 2007–2018. Note that the gestational age estimation from use of the last menstrual period estimate through 2006 to the obstetric estimate starting in 2007 partially explains the preterm birth decrease from 2006 to 2007 (Martin et al. 2015)

Gohlke, J.M., 2021. Human health in coalfield communities of Appalachia. In *Appalachia's Coal-Mined Landscapes* (pp. 311-336). Springer, Cham.

Predictive Air Quality and Health Risk Study of Proposed Metallurgical Coal Mining in the Livingstone Area

Funding : Pekisko Group

Lead Researcher: Mandy Olsgard

Teck Elk Valley

- Dust management and air quality monitoring
- PM and SO2 exceed air quality guidelines
- Sparwood residents compensated
- 241 public complaints
  - Odours
  - Nuisance dust
  - Visibility
  - Health effects

Airborne dust has been an ongoing concern in Sparwood. File photo

Teck to compensate Sparwood residents for dust

House cleaning among mitigation measures pitched by focus group; plus former Mayor joins SCEEAC

KIMBERLEY VLASIC / Mar. 23, 2019 3:30 p.m. / LOCAL NEWS / NEWS

ANNUAL TECK COAL LTD.
REGIONAL AIR MONITORING
PROGRAM REPORT
2020-03-31
SPARWOOD, BC

2019 ANNUAL REPORT

RWDI #2001654
March 31, 2020

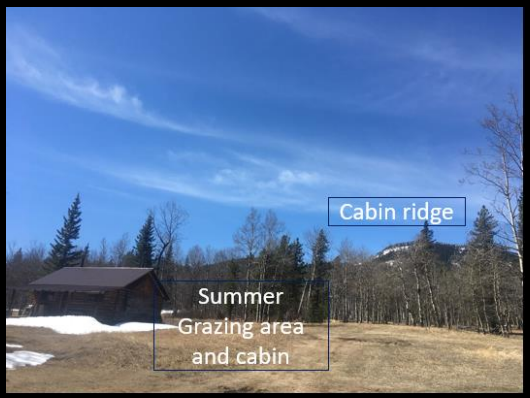
Goal

Assess potential health risks from exposure to air contaminants released from metallurgical coal mining:

- Residents
- Livestock
- Grazing pasture

Land Uses in SSR Chart

Conservation management areas on public lands	11.4%
Agriculture • cultivated • grazing	67.2% • 40.5% • 26.7%
Forestry	6.2%
Recreation/tourism on Public Lands	0.5%
Urban Centres	1.9%
Parks and Protected Areas (PPAs)	6.1%
Military	2.6%
First Nations Reserves	4.1%



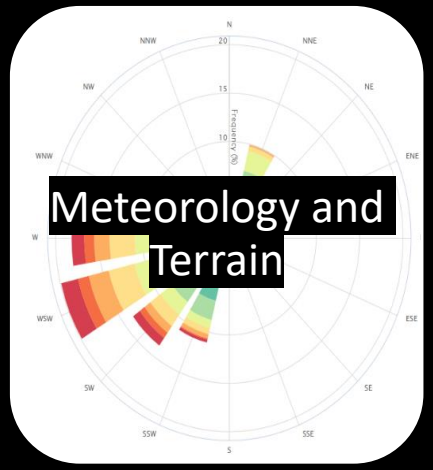
Jaremko, S.L., 2016. A Critical Exploration of the South Saskatchewan Regional Plan in Alberta.

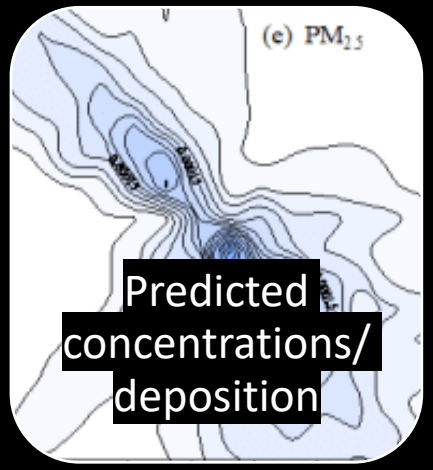
Conceptual Model

Activity	Sources	Emission type	Contaminants of Potential Concern COPCs)	Transport Pathway	Exposure Pathway (primary)	Exposure Pathway (secondary)	Receptor of Concern
Surface Coal Mine (Mountain Top Removal Mining)	Coal Mine areas Drilling areas Dump areas Rail load areas Reclamation areas Stockpile areas Waste strip areas*	Diesel Combustion Blasting*	SO2*, NOx*, $PM_{2.5}$, PM_{10}, TSP Trace elements and heavy metals (Al, As, Ba, Cd, Cr, Hg, Mo, Mn, Ni, Pb, Sb, Se, Tl, U, V, Zn)	Air	Inhalation	---	Human Livestock
			Acid compounds (SO_2, SO_4^{-2}, NO_2, NO_3^-, HNO_2, HNO_3) Base Cations (K^+, Na^+, Ca^{2+}, Mg^{2+}) Trace elements and heavy metals (Al, As, Ba, Cd, Cr, Hg, Mo, Mn, Ni, Pb, Sb, Se, Tl, U, V, Zn)	Deposition	Direct	---	Vegetation Water Soil
					---	Ingestion	Human Livestock
	Coal Mine areas Drilling areas Dump areas Rail load areas Reclamation areas Stockpile areas Waste strip areas*	Fugitive dust	PM2.5, PM10, TSP including bound; -Base Cations (K^+, Na^+, Ca^{2+}, Mg^{2+}) -Trace elements and heavy metals (Al, As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mo, Mn, Ni, Pb, Sb, Se, Tl, U, V, Zn)	Air	Inhalation	---	Human Livestock
				Deposition	Direct	---	Vegetation Water Soil
					---	Ingestion	Human Livestock
Local Infrastructure	Highways Communities	Road emissions Area emissions	See diesel combustion See fugitive dust	Air	Inhalation	---	Human Livestock
				Deposition	Direct	---	Vegetation Water Soil
					---	Ingestion	Human Livestock

Methods

Step 1: Air Dispersion Model (CALPUFF)





Step 2: Risk Assessment

Estimate uptake by plants

Estimate uptake by livestock

Estimate uptake by humans

Compare to safe exposure levels

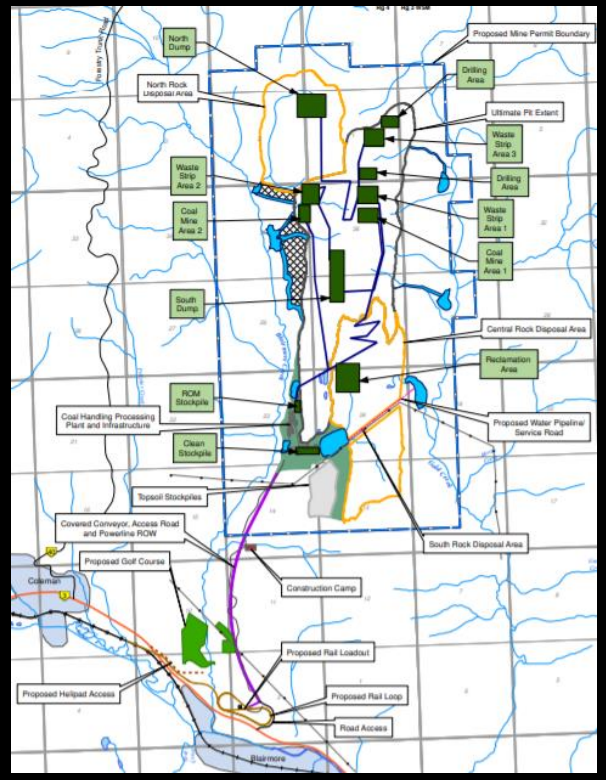
Compare to agricultural guidelines

Compare to human health guidelines

Compare to environmental health guidelines

Creating the Cumulative Mine Scenario

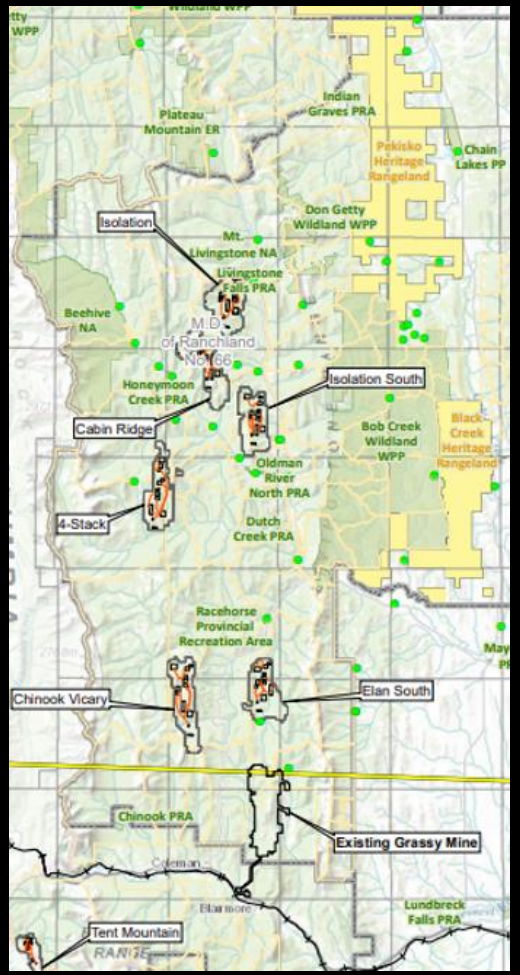
Step 1: Generate Grassy Mountain emission profile and validate PDC model



Step 2: Identify ratios to create mine plans with scaled air emission sources

Project	Cumulative Area of Disturbance (ha)	Disturbance Area Scaling Factor
Grassy Mountain	1,244	1.00
Tent Mountain	364	0.29
Elan South	1,261	1.01
Isolation South	1,278	1.03
Cabin Ridge	1,276	1.03
Isola	1,354	1.09
4-Stack	1,235	0.99
Chinook (Vicary)	1,334	1.07

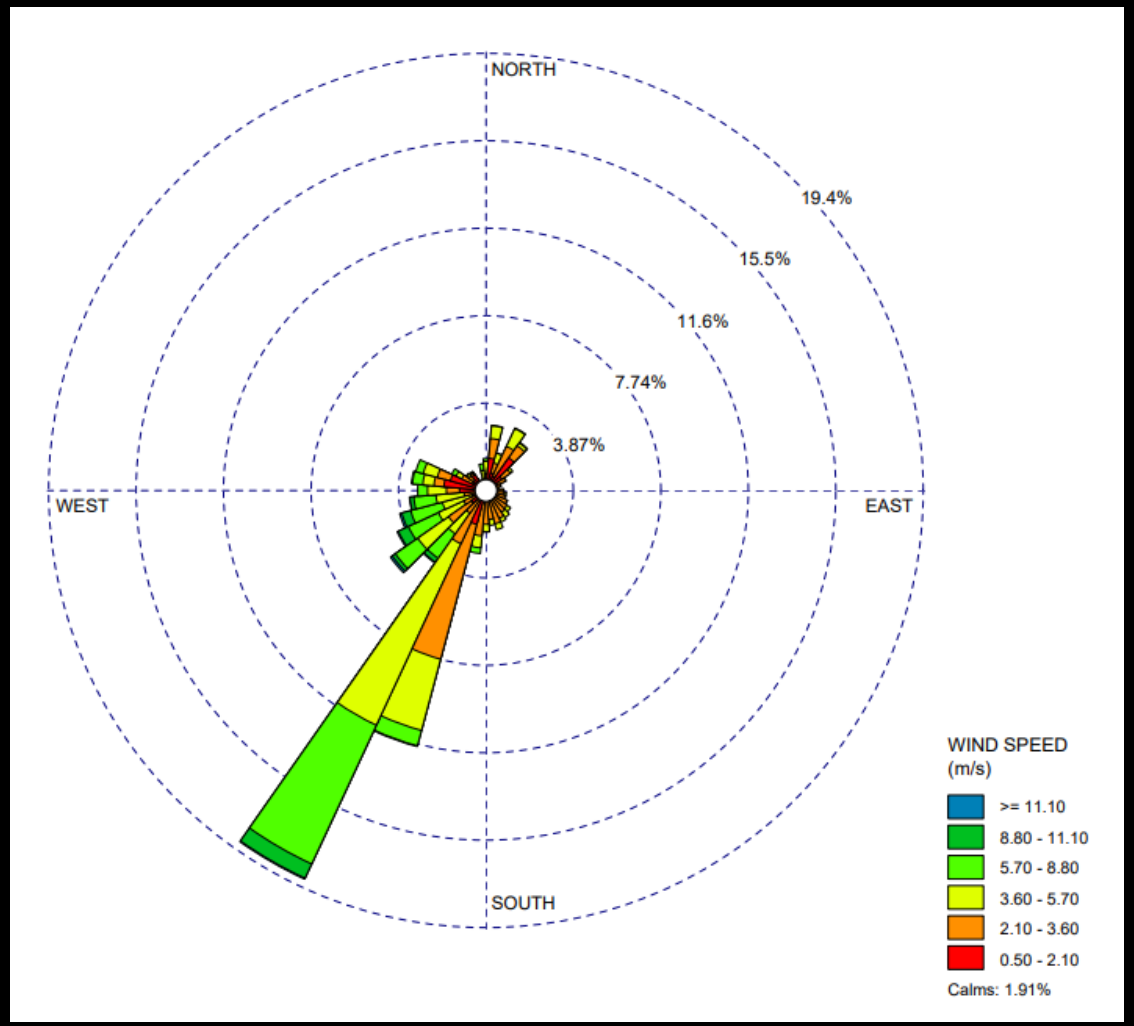
Step 3: Create source emission profile for PDC with 8 mines



Step 4: Compare predicted concentrations to Air Quality Guidelines

Parameter	Averaging period	Health Protection	Provincial (AAAQO)	Federal (CAAQS)	Global (WHO)
			99th %ile	Variable	Mean
TSP	Daily		100	---	---
	Mean	Human	60	---	---
	Hourly		80	---	---
$PM_{2.5}$ (ug/m^3)	Daily		29	27	25
	Monthly	Human	---	---	
	Annual		---	8.8	10
PM10 (ug/m^3)	Daily	Human			20
	Annual				50
SO_2 (ug/m^3)	Hourly	Human	450	192.8	
	Daily		125	---	20
	Monthly		30	---	---
	Annual	Environment	20	13.08	---
NO_2 (ug/m^3)	Hourly	Human	300	112.83	200
	Daily		---	---	
	Monthly		---	---	
	Annual	Environment	45	31.97	40

Results – Meteorology and Air Quality

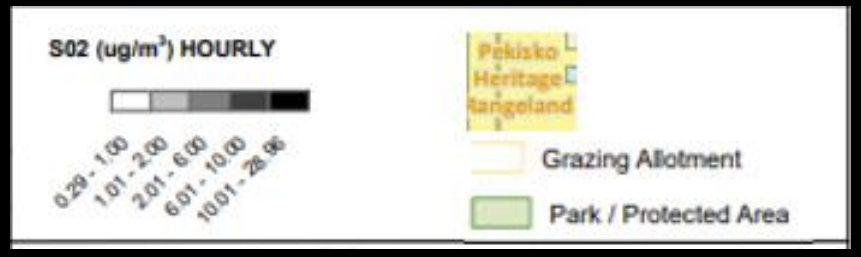


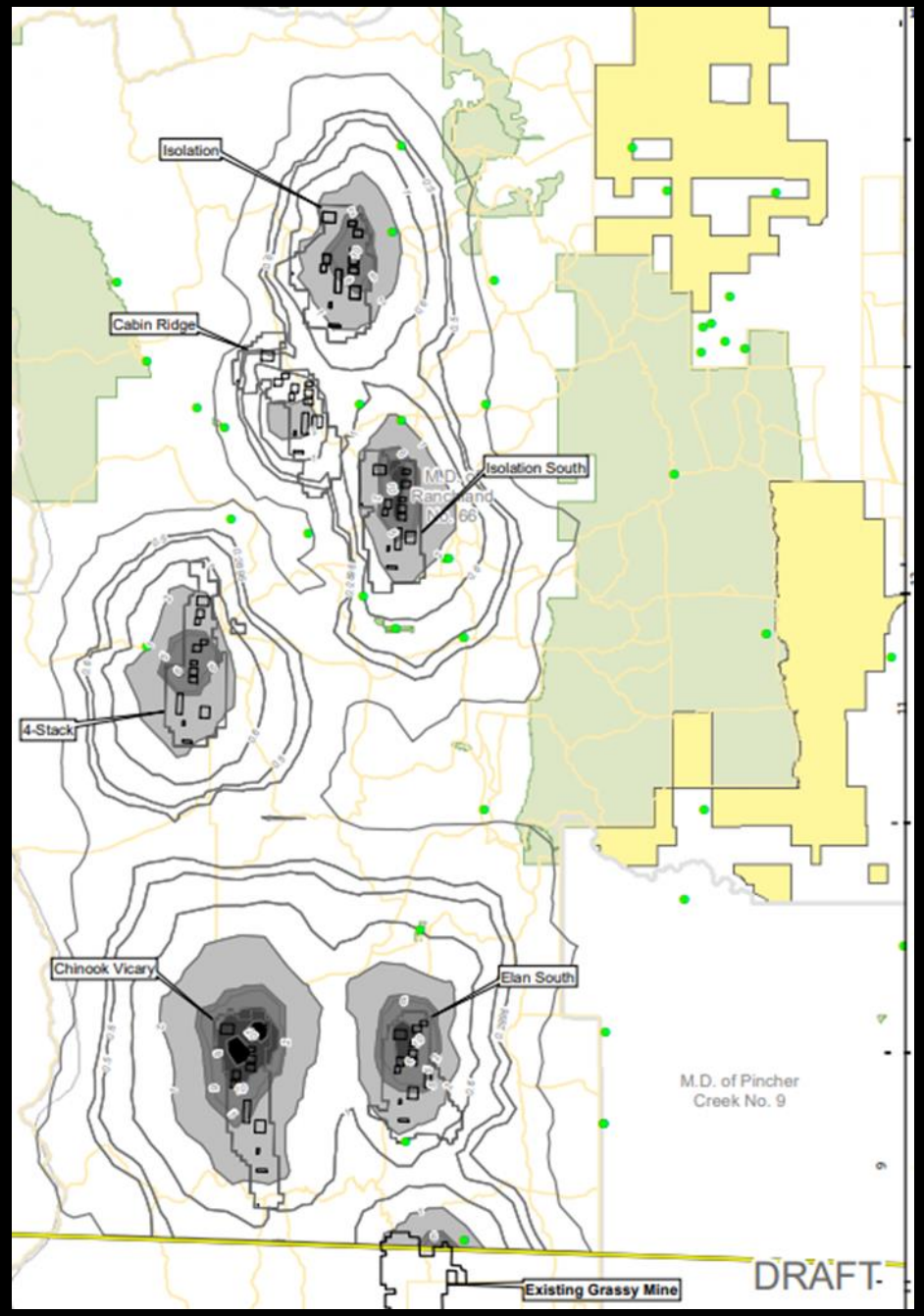
- Meteorology
  - No local data
  - No ground level data
  - Provincial MM5 Upper air data set
    - Maximum wind speed 39 km/hr (11 m/s)
- Air quality data not available

Results:
Sulphur dioxide (hourly)

Average Period	Maximum (ug/m^3)	99th percentile (ug/m^3)	Lowest Guideline (ug/m^3)	Source	Predicted Exceedance
Hourly	32.23	28.96	192.8	CAAQS	N

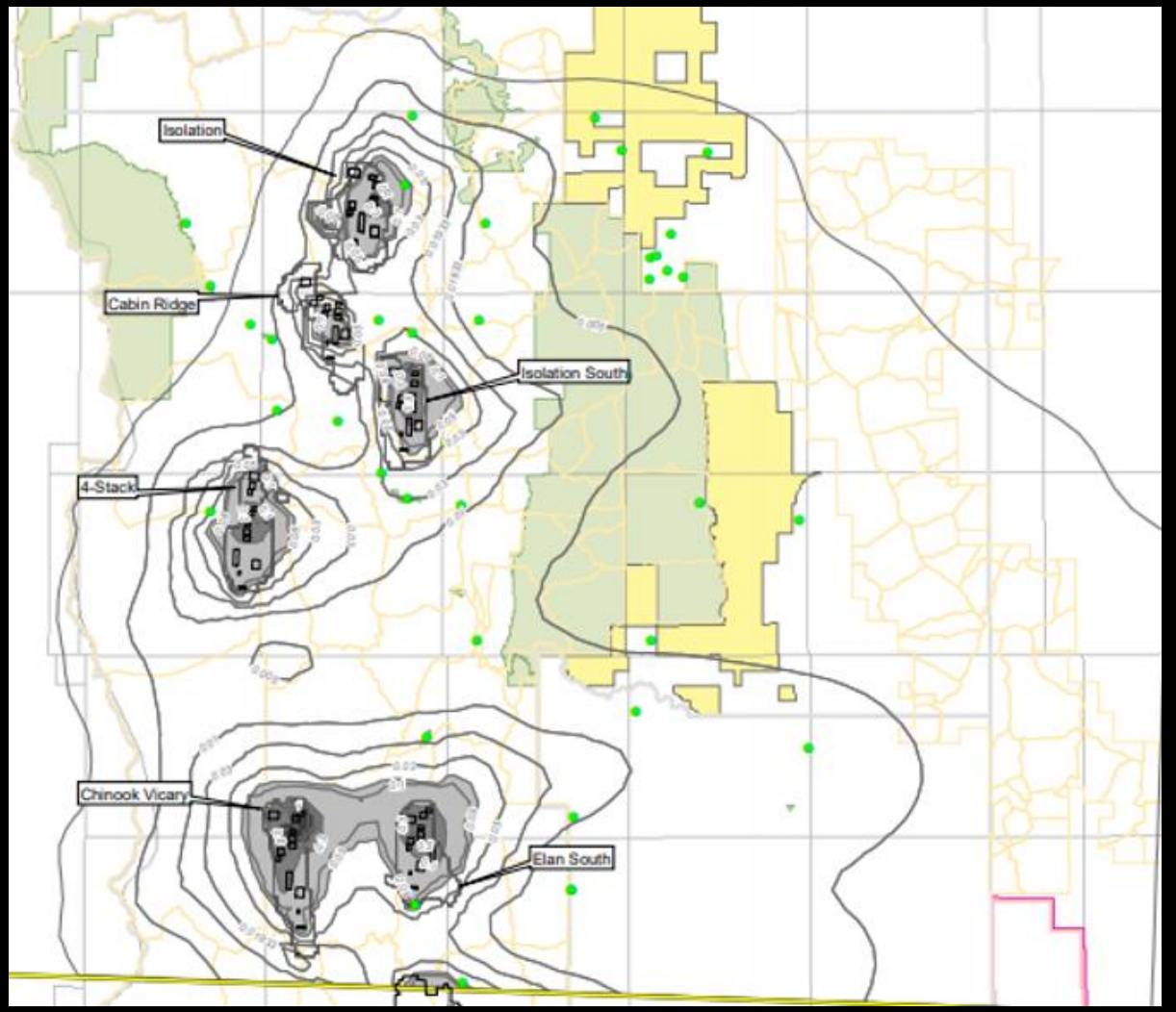
Sensitive receptor
(ranch, residence, cabin, grazing)





Results:
Sulphur dioxide (annual)

Average Period	Maximum (ug/m^3)	99th percentile (ug/m^3)	Lowest Guideline (ug/m^3)	Source	Predicted Exceedance
Annual	1.93	---	13.08	CAAQS	N

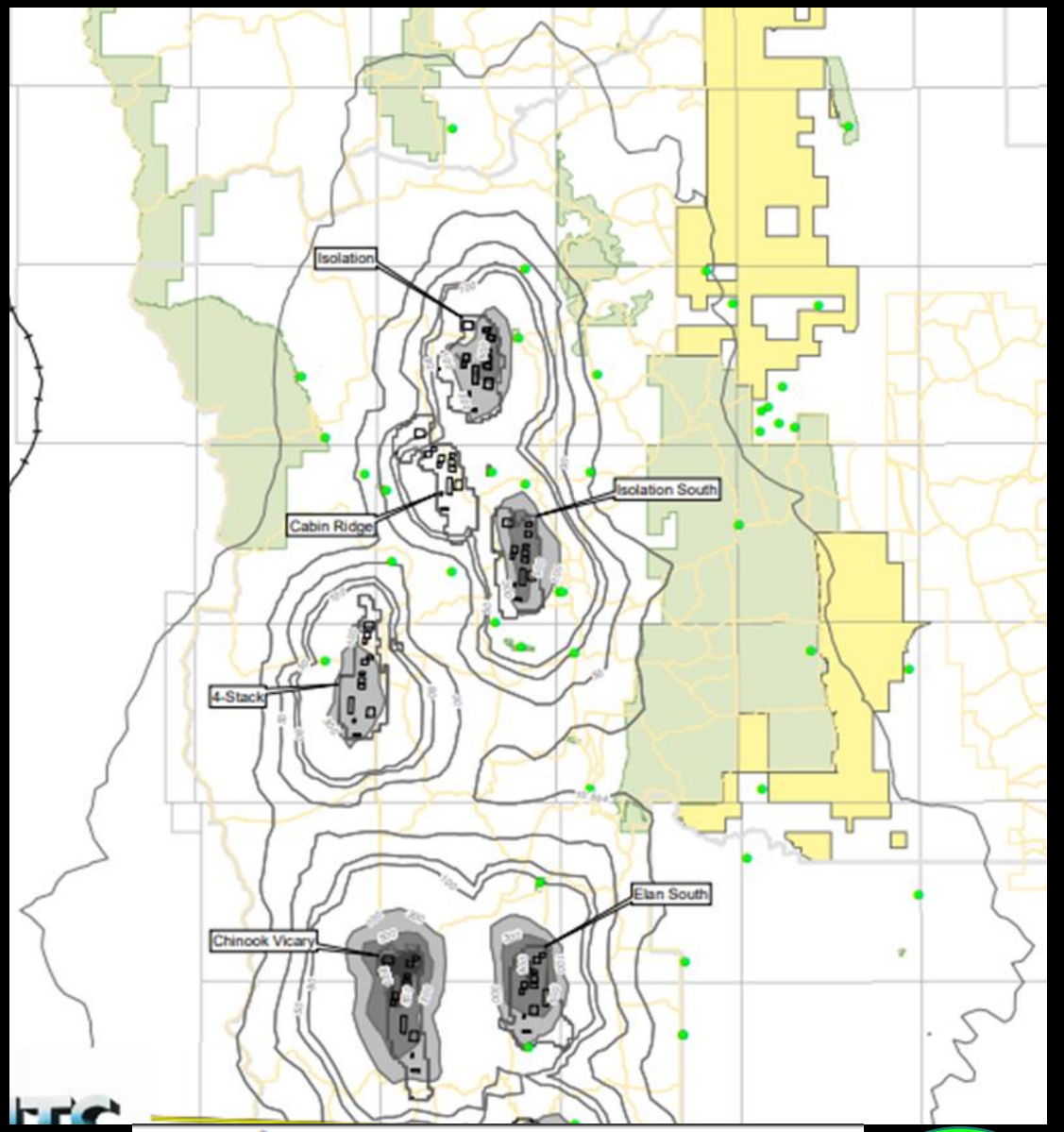


Sensitive receptor

Results:
Nitrogen dioxide (hourly)

Average Period	Maximum (ug/m^3)	99th percentile (ug/m^3)	Lowest Guideline (ug/m^3)	Source	Predicted Exceedance
Hourly	1263.10	1055.40	112.83	CAAQS	Y

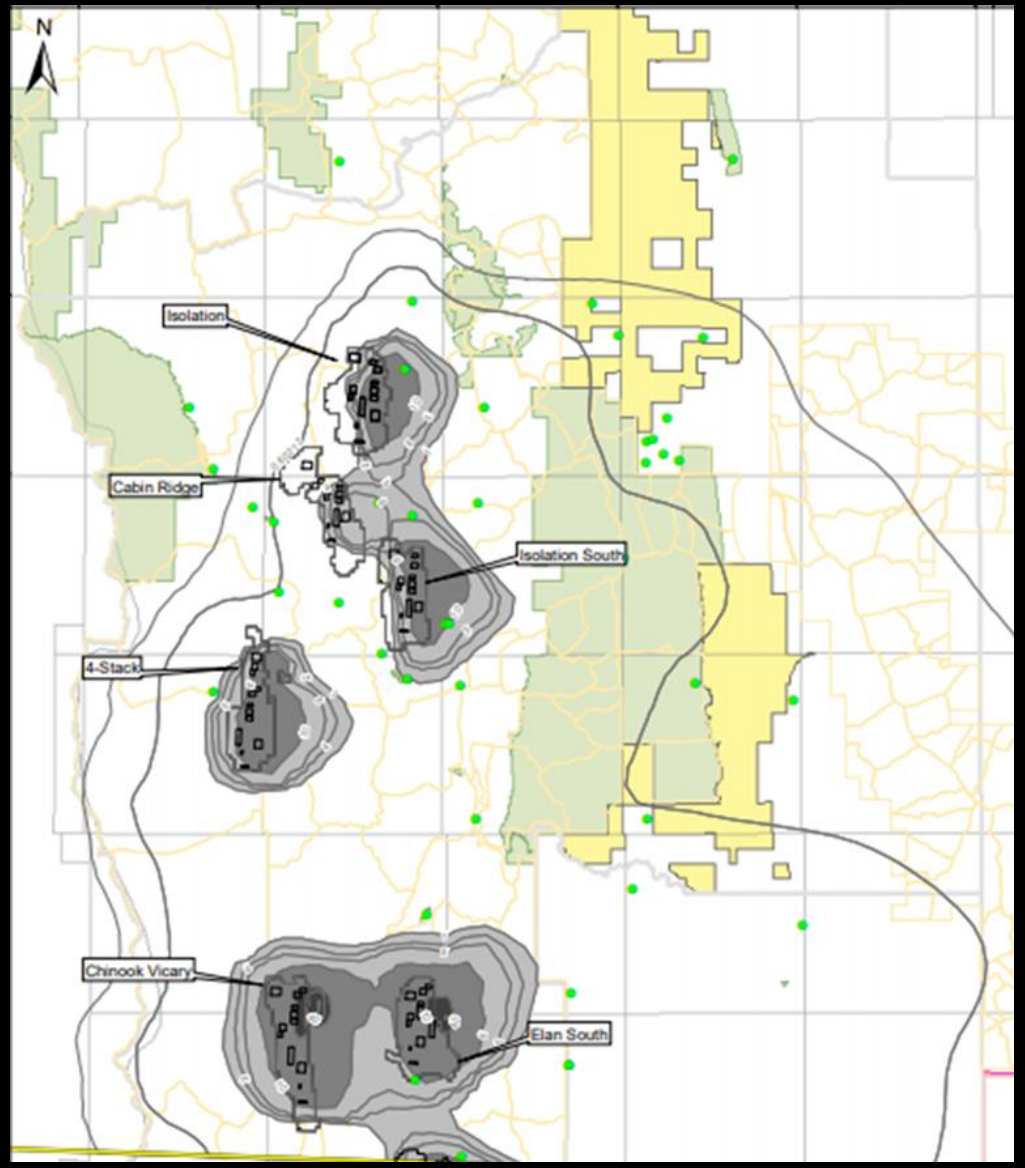
	Max	99%ile	Location
AAAQO	300		
SSRP	---		
CAAQS	112.83		
WHO	200		
MPOI	1055.4		
1-HOUR	399.89	292.67	LVST_F
1-HOUR	295.64	243.53	N_RCKP
1-HOUR	164.54	125.61	OM_RVR
1-HOUR	164.69	123.69	ATRM_EN
1-HOUR	294.39	243.60	BLADE_C
1-HOUR	282.73	234.43	MCLY_CRK
1-HOUR	126.45	99.81	PLT_SW
1-HOUR	183.00	132.52	RCKP_SW



Results:
Nitrogen dioxide (annual)

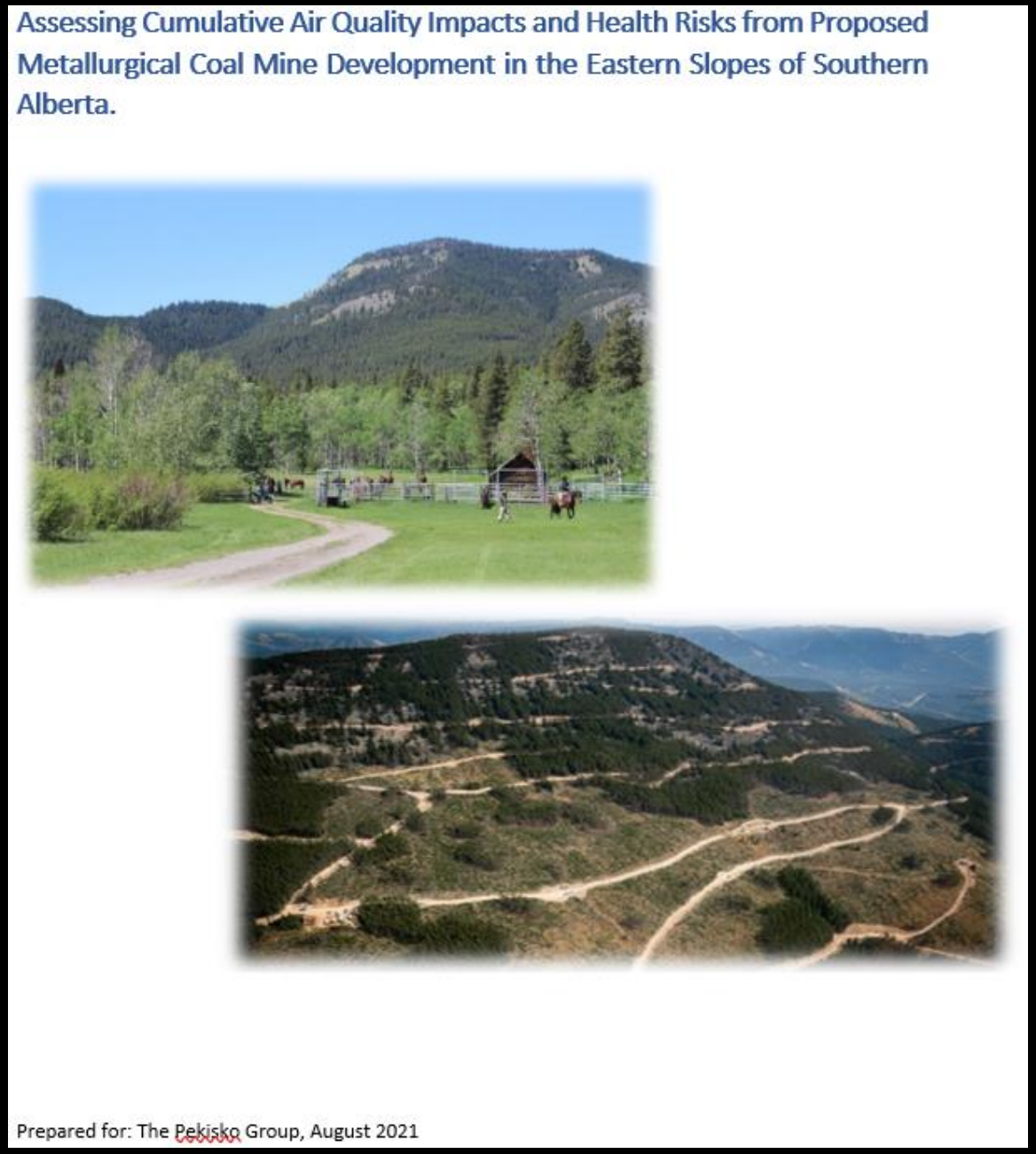
Average Period	Maximum (ug/m³)	99th percentile (ug/m³)	Lowest Guideline (ug/m³)	Source	Predicted Exceedance
Annual	60.21	---	31.97	CAAQS	Y

	Max	Location
AAAQO	45	
SSRP (average)	45 (limit)	
	30 (level 2)	
	15 (level 3)	
CAAQS	31.97	
WHO	40	
MPOI	60.21	



Next Steps

- Complete analysis
  - Particulate matter
  - Metal deposition – live stock risk
  - Acid deposition – plant health risk
- Submit report to panel August 29



Conclusions (to date)

1. Surface coal mining is not just an environmental issue
2. Increased prevalence of diseases associated with mortality in communities near surface coal mining
3. Grassy mountain mine application does not reflect the planned development case
4. Lack of baseline air monitoring and meteorology data limits modelling and assessment of coal mining projects
5. First study assessing risks to livestock and grazing/ forage/ grassland health

Recommendations

1. Fact check, valid submissions, flag misinformation
2. Policy that protects the Pekisko Heritage Rangelands – now and in the future
3. Panel recommendations need to address gaps and reflect Alberta Government Ministries (mandates and responsibilities)
   - Agriculture and Forestry
   - Energy
   - Environment and Parks
   - Health
4. Engage Agriculture and Forestry
   - Provide assessment of risk to agriculture and policy direction to DOE
5. Engage Alberta Health
   - Provide assessment of public health risks and policy direction to DOE

Questions?

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